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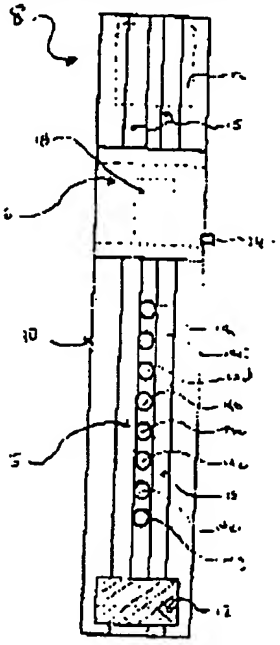
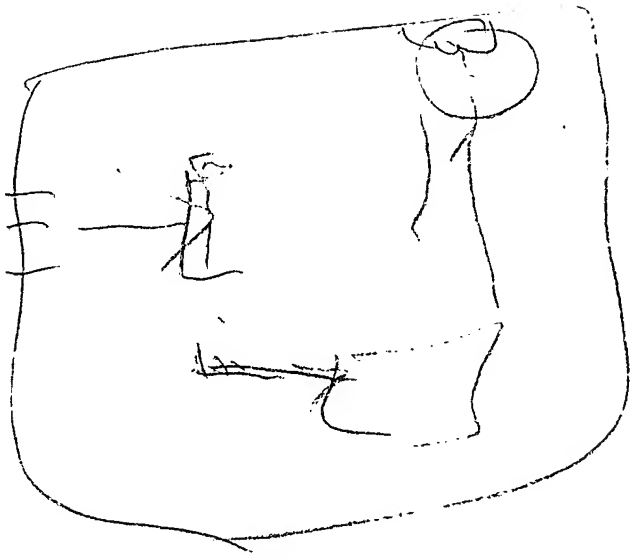
(54) SEQUENTIALLY PULSED LED SAFETY DEVICE

(54) DISPOSITIF DE SECURITE A DIODES ELECTROLUMINESCENTES A IMPULSIONS SEQUENTIELLES

Representative Drawing:





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ABSTRACT:

A safety device employing Focused Light Emitting Diodes is described. The use of focused LEDs allows the construction of highly visible, portable safety displays. Embodiments of the invention include arm bands and vests, suitable for use by cyclists, joggers or highway workers; a unit suitable for mounting on a bicycle; and a unit suitable for replacing traffic cones and safety flares. The units have at least two focused LEDs and are battery operated. The LEDs are intermittently operated to simulate motion and thus heighten the degree of visual conspicuousness of the devices. The traffic cone embodiment includes a rechargeable battery, a remote control to select one of several different modes of operation and a magnetic

base to help affix the cone to metal surfaces such as a vehicle roof.

CLAIMS: Show all claims

*** Note: Data on abstracts and claims is shown in the official language in which it was submitted.

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ABSTRACT

A safety device employing Focused Light Emitting Diodes is described. The use of focused LEDs allows the construction of highly visible, portable safety displays. Embodiments of the invention include arm bands and vests, suitable for use by cyclists, joggers or highway workers; a unit suitable for mounting on a bicycle; and a unit suitable for replacing traffic cones and safety flares. The units have at least two focused LEDs and are battery operated. The LEDs are intermittently operated to simulate motion and thus heighten the degree of visual conspicuousness of the devices. The traffic cone embodiment includes a rechargeable battery, a remote control to select one of several different modes of operation and a magnetic base to help affix the cone to metal surfaces such as a vehicle roof.

This invention relates to the field of safety devices.

In many activities it is important, from a safety viewpoint, that a person or object be seen clearly and noticeably. People such as cyclists, highway workers, joggers, motorcyclists, hikers, etc., may be at risk if they are not visually conspicuous. As well, the safety of the public is enhanced if objects such as traffic cones, median dividers, etc. are visually conspicuous.

In the past, to increase the visibility of an object, reflective displays were employed which could be worn by a person or attached to an object. This would render the person or object visually conspicuous when in conditions of low ambient light.

However, these reflective displays suffer disadvantages in that they assume that a suitable light source, such as a vehicle headlight, would be directed onto them and that the light reflected back from the object would be sufficient to draw attention to the display. As such, the effectiveness of the reflective display is limited during conditions of high ambient light, such as daylight, or when no light source is directed at the display, or when the display is visually obscured by fog or mist.

To overcome these disadvantages, active light source safety devices have been used. One form of active light safety device is the chemical flare. Typically, the flare is ignited and placed in an appropriate location to warn motor vehicle drivers or others of temporary hazards or obstacles such as stalled vehicles or accident sites. The bright and colored

light given off by the flare is visually conspicuous, even in conditions of high ambient light. Unfortunately, chemical flares suffer from disadvantages as well.

A first disadvantage is that chemical flares may pose a fire hazard when stored or used. A second disadvantage exists in that many flares contain toxic chemicals which may harm the environment. Some states have prohibited the use of chemical flares for these reasons. Additionally, flares are impractical or too expensive for regular use, such as by joggers, cyclists, etc.

Active light safety devices suitable for regular use at a reasonable cost typically utilize an electrically powered light source. The light source may be colored or may be operated intermittently or both, to ensure that the display is visually conspicuous. Electrically powered devices differ from chemical flares in that they do not typically pose a fire hazard or release toxic chemicals.

As the human eye is particularly adept at detecting motion, an electrical safety display will often contain more than one light source, each of which may be activated intermittently to enhance the visibility of the display. For example, two light sources may be arranged to be illuminated in an alternating manner, thus simulating motion.

While these electric active light source devices are effective in many situations, they too suffer from disadvantages. In conditions of high ambient light, such as daylight, the brightness of the light source may not be sufficient to ensure that the

display will be visually conspicuous. This is especially a problem when the devices are implemented for portable operation by pedestrians or cyclists, as the size and weight of the device and its power supply are often limited.

Typically, a portable electric active light display is battery operated and can not be of excessive size or weight. Thus, a compromise must be reached between the lifespan of the battery and the amount of light produced by the display and hence its visual conspicuousness. This is due to the fact that typically, a direct correlation exists between the amount of light produced by an electrically powered light source and the amount of power consumed by the light source. The lifespan of the battery is thus decreased as the brightness of the light source is increased.

Similarly, the greater the number of light sources, the greater the total power consumption, and a decreased battery lifespan results.

This effectively leads to a compromise being required between the safety factor of the device, as defined by its degree of visual conspicuousness, and the size and duration of the power source.

To overcome these disadvantages, the semiconductor light emitting diode, LED, has been used in the past in safety devices as it offers a reasonable compromise between power consumption and brightness. In U.S. Patent 4,860,177 to Simms, for example, a bicycle safety device is shown which employs a sequenced array of LEDs to improve the visibility of a bicycle to motorists at night.

U.S. Patent 4,523,259 to Morse et al. shows a safety belt for joggers with LEDs arranged along the belt. The LEDs flash to improve the visibility of the wearer in conditions of low ambient light.

However, the above proposals suffer from a disadvantage as well. The amount of light that is transmitted from an LED is not sufficient to be visually conspicuous in daylight or at long range in low ambient light conditions. The safety factor provided by LED displays is therefore less than ideal.

It is therefore an object of the present invention to obviate or mitigate at least one of the above described disadvantages.

According to the present invention, there is provided a safety device comprising support means; at least two focused LEDs disposed on the support means; connection means for connecting the LEDs to a power supply; and switch means being operable to connect and disconnect a power supply to the LEDs.

Embodiments of the present invention will now be described, by way of example only, with reference to the following drawings in which:

Figure 1 shows a front view of a safety arm band;

Figure 2 shows a rear view of the safety arm band shown in Figure 1;

Figure 3 shows a rear perspective view of a safety vest;

Figure 4 shows a front perspective view of the safety vest shown in Figure 3;

Figure 5 shows a side view of a traffic safety cone;

Figure 6 shows a perspective view of a handheld remote control for the traffic safety cone of Figure 5;

Figure 7 shows a perspective view of a bicycle safety unit; and

Figure 8 shows a bottom view of the unit of Figure 7.

The present invention employs focused LEDs as light sources in a safety display device.

LEDs are typically fabricated from a semi-conductor diode which is encased in a plastic epoxy bubble. This bubble serves two functions; the first to protect the delicate semi-conductor diode; and the second to form a collimating lens to direct the light emitted from the diode. This lens typically concentrates a portion of the light emitted from the diode through an angle of dispersion of approximately 140°.

Focused LEDs, on the other hand, feature a high quality collimating lens which provides an angle of dispersion of approximately 1°. While focused LEDs operate with a power consumption similar to that of other LEDs and produce a similar amount of light, the improved collimating lens directs more of this light in a useful direction. Thus the focused LED is effectively brighter, albeit over a narrowed range of view, without any increase in power consumption.

An embodiment of the present invention, suitable for use by joggers, pedestrians and others is shown in Figures 1 and 2.

Referring to Figures 1 and 2, a safety arm band 8 is shown. A cloth band 10 is provided with a closure 12 which is preferably of the Velcro (TRADE-MARK) type. While the band 8 may be of any suitable color, international safety yellow has been found to be particularly effective in the preferred embodiment. Focused LEDs 14 are attached to a first side of the band 10 in a linear arrangement. A reflective stripe 15 is provided along each side of the LEDs 14. An enclosure 16 is also attached to the first side of the band and is sized to receive a battery. An electrical circuit board 18 is placed against the second side of the band 10, opposite the battery enclosure 16, and a cloth cover 20 is sewn over the circuit board 18 and the wiring 22 which connects the LEDs 14 and the circuit board 18. The circuit board 18 has a ON/OFF switch 24 which passes through an aperture in the cover 20. The electronic circuit on circuit board 18 is preferably constructed using commonly available semi-conductor integrated circuitry, such as a 555 timer chip and a 4017 sequencer chip, or similar which are well known to those of skill in the art. The use of integrated circuitry offers low power consumption, good reliability and small size.

In use, a battery is connected and placed in the enclosure 16 and the band is placed about the upper arm of the user and fastened with the closure 12. The switch 24 is placed in the ON position and the electrical circuit illuminates the LEDs 14 in a predefined sequence. In one preferred embodiment, the LED 14a and LED 14b are first illuminated, while the remaining LEDs 14 are extinguished. After a short delay, LEDs 14a and 14b are extinguished and 14c and 14d are illuminated, then 14c and 14d are extinguished after another short delay and 14e and 14f are illuminated.

The sequence continues until finally LEDs 14g and 14h have been illuminated and the sequence repeats with 14g and 14h being extinguished and 14a and 14b being illuminated. In this manner two LEDs 14 are illuminated at any one time and the two LEDs 14, which are illuminated, are changed in a sequence to visually simulate movement and thus make the arm band 8 visually conspicuous.

It should be understood that the sequence described above is significant only in that it makes the arm band 8 visually conspicuous. It should thus be understood that the present invention is not limited to any particular sequence or sequences of LEDs, or to any particular number of light sources.

Another embodiment of the present invention is the safety vest unit 28, shown in Figures 3 and 4. A vest 30 has focused LEDs 32 attached to its outside. A battery enclosure 34 is fastened to the outside of the vest 30, as is an enclosure 36 for an electrical circuit board 38 which has an ON/OFF switch 40 which passes through an aperture in the enclosure 36. The vest 28 functions in a similar manner to the arm band 8 in that when a battery is connected to it and the switch 40 is in the ON position, the LEDS 32 are illuminated and extinguished in a sequence to help make the vest visually conspicuous.

A third embodiment of the present invention is a traffic cone 44, shown in Figure 5. A plastic cone 46 has focused LEDs 48, arranged in bands 49A,49B, attached to its outside. The LEDs 48 in the band 49A are preferably green in color while those in the band 49B are preferably amber.

A series of strobe lights 60, preferably of the gas-discharge type, are arranged in a third band 59 located near the apex of the cone 46. These strobe lights 60 are preferably red in color and are used to increase further the visual conspicuousness of the cone when necessary. However, as the power consumption of the strobe lights is very much greater than that of the focused LEDs, it is anticipated that use will be made of the strobe lights only when absolutely required such as during foggy conditions on high speed roadways where visibility from a maximum distance is desired.

A receptacle is provided at the base of the cone 46 to receive a battery 51 and an electronic circuit board 52. The base of the cone 46 has magnets 54 affixed to it to help maintain the position of the cone when it is placed atop a metal surface such as a car hood or trunk. An electrical connector 56 is also located near the base of the cone 46 and can receive an electrical current for recharging the battery 51 when the cone is stored or serviced. An ON/OFF switch 58 is located above the receptacle 56 and an infrared receiver element 50 is located at the apex of the cone 44. Receiver element 50 is of conventional construction and is adapted to receive signals from a remote control unit, shown in Figure 6.

Figure 6 shows a handheld infrared remote control 62 for the traffic cone 44. The remote control is constructed in a manner well known to those of skill in the art and its construction is not particularly restricted. It should be understood that this embodiment of the present invention is not limited to an infrared control and that a radio or ultrasonic control could be used instead.

An ON/OFF switch 63 is provided on the control 62, as are six switches 64, each of three pairs corresponding to a clockwise and a counter-clockwise rotation, for each of the three bands 49A,49B,59 of light elements on the cone 44.

In operation, the traffic cone 44 is placed on the road, vehicle hood or other suitable surface and the switch 58 is placed in the ON position. The remote control 62 is turned on with switch 63 and the operator activates one or more of the switches 64 on the remote control unit 62.

The unit 62 generates infrared commands in the form of specific, predefined signals which are received and understood by the receiver element 50 on the cone 44. Depending on the particular command received by the receiver element 50, the electronic circuit 52 in the cone 44 sequentially illuminates the light elements 48,60 in one or more of the bands 49A,49B,59.

Using the remote control 62, the operator can thus select one or more of bands 49A,49B,59 to be illuminated or extinguished and may also control the sequencing of the light elements in the bands 49A,49B,59. It is anticipated that the light elements may be activated so that they are sequenced in a left-to-right or right-to-left pattern, with a selectable sequencing speed.

Thus, the cone 44 may be placed in a conspicuous place and traffic may be re-directed around it, to the left or right depending upon the sequence of the light elements.

A further preferred embodiment of the present invention is the bicycle safety unit shown in Figures 7 and 8. The safety unit 66 has a case 68 with three front faces 70, each face 70 subtending approximately 60° of a 180° arc.

The case 68 also has a receptacle 72 to receive a battery and a resilient clasp 74 which is used to mount the safety unit 66 to a bicycle frame member or seat post. The unit 66 is sized to be easily carried in a pocket and the resilient clasp 74 allows the unit to be quickly attached or removed from a bicycle. In this manner the unit 66 may be removed when the bicycle is left unattended, thus avoiding the possibility of theft of the unit 66.

A weatherproof ON/OFF switch 76 is attached to the case 68 and is used to activate an electronic sequencing circuit 78 located inside the case 68.

Each of the front faces 70 have a set of three focused LEDs 71 mounted upon them. The LEDs 71 of each set are mounted such that their emitted light is directed in substantially the same direction as the other LEDs of the same set. Thus the three sets of LEDs form three regions of high visibility approximately 60° degrees apart, within a 180° arc about the front of the unit 66.

In operation, the unit 66 is clipped to a bicycle frame member and the switch 74 is placed in the ON position. The electronic sequencing circuit 78 lights and extinguishes the LEDS 71 in a fashion similar to that of the other embodiments, to make the unit visually conspicuous.

In a preferred embodiment, the LEDs 71 are sequenced from the center of the middle face 70B out to the side faces 70A,70C.

It should be understood that the present invention is not limited to the specific embodiments described hereinabove, and persons of skill in the art may make modifications to those embodiments without departing from the spirit of the invention.

We claim:

1. A safety device comprising:

support means;

at least two focused LEDs disposed on said support means;

connection means for connecting said LEDs to a power supply; and

switch means being operable to connect and disconnect a power supply to said LEDs.

2. A safety device according to claim 1 further comprising a power supply connected to said connection means.

3. A safety device according to claim 2 further comprising control means operable to connect and disconnect intermittently said power supply to said focused LEDs.

4. A safety device according to claim 3 wherein said support means is an elongate flexible band.

5. A safety device according to claim 4 wherein said focused LEDs are disposed in a substantially lengthwise arrangement along a portion of said band.

6. A safety device according to claim 5 wherein said band is further equipped with reflective material in proximity to said focused LEDs.

7. A safety device according to claims 1, 5, or 6 wherein said band is international safety yellow in color.

8. A safety device according to claims 1, 2, 3, 4, 5, or 6 wherein at least two of said focused LEDs are illuminated at one time.

9. A safety device according to claim 3 wherein said support means is a garment having a back panel.

10. A safety device according to claim 9 wherein said focused LEDs are mounted to the outer surface of said back panel.

11. A safety device according to claim 10 wherein said focused LEDs are arranged in a two dimensional array.

12. A safety device according to claims 9, 10 or 11 wherein at least two of said focused LEDs are illuminated at any one time.

13. A safety device according to claim 3 wherein said support means is a rigid enclosure.

14. A safety device according to claim 13 wherein said support means is adapted to be mounted on an object.

15. A safety device according to claim 14 wherein said focused LEDs are arranged in groups with each group containing at least one focused LED, a first one of said groups emitting light substantially directed along a first axis, at least a second of the other said groups emitting light substantially direct along other axis, said other axis forming an angle with said first axis.

16. A safety device according to claim 15 wherein each said other axis diverges from said first axis.

17. A safety device according to claim 13 wherein said power supply is adapted to be rechargeable.

18. A safety device according to claim 17 wherein said support means includes a substantially flat base and a display surface inclined to the plane of said base surface at an angle in the range of 30 to 90 degrees, said focused LEDs being mounted to said display surface.

19. A safety device according to claim 18 wherein said display surface comprises an inverted cone.

20. A safety device according to claims 18 or 19 wherein said base is adapted to be magnetic.

21. A safety device according to claim 18 wherein said focused LEDs are arranged in at least one band about said display surface.

22. A safety device according to claim 21 wherein said control means is operable in different modes, each said mode independently illuminating and extinguishing said focused LEDs in at least one of said bands.

23. A safety device according to claim 21 or 22 further including portable activation means, said activation means being operable to communicate with said control means to select said mode.

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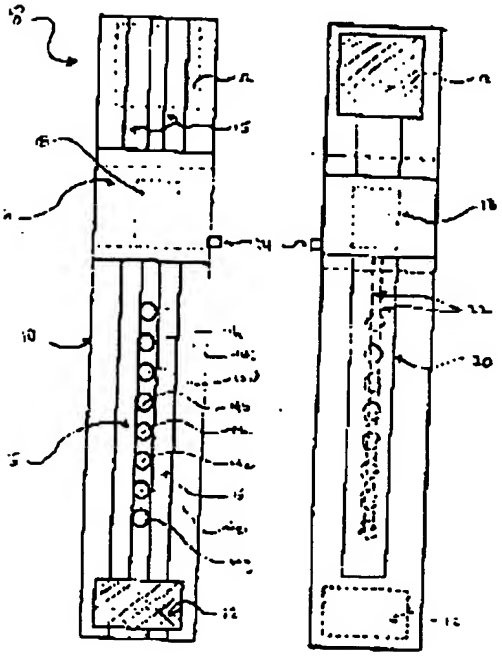

FIG. 1

FIG. 2

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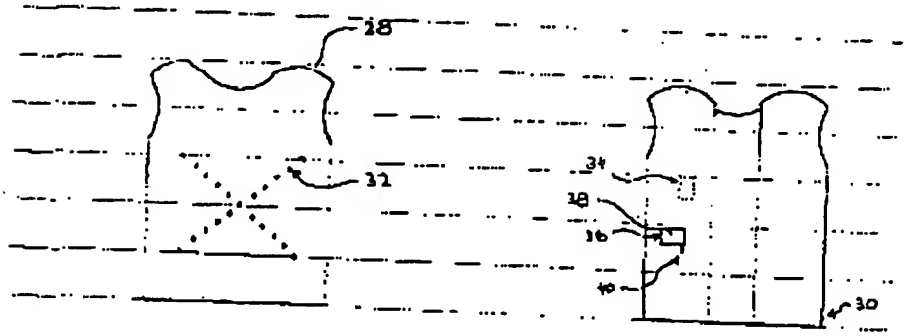

FIG. 3

FIG. 4

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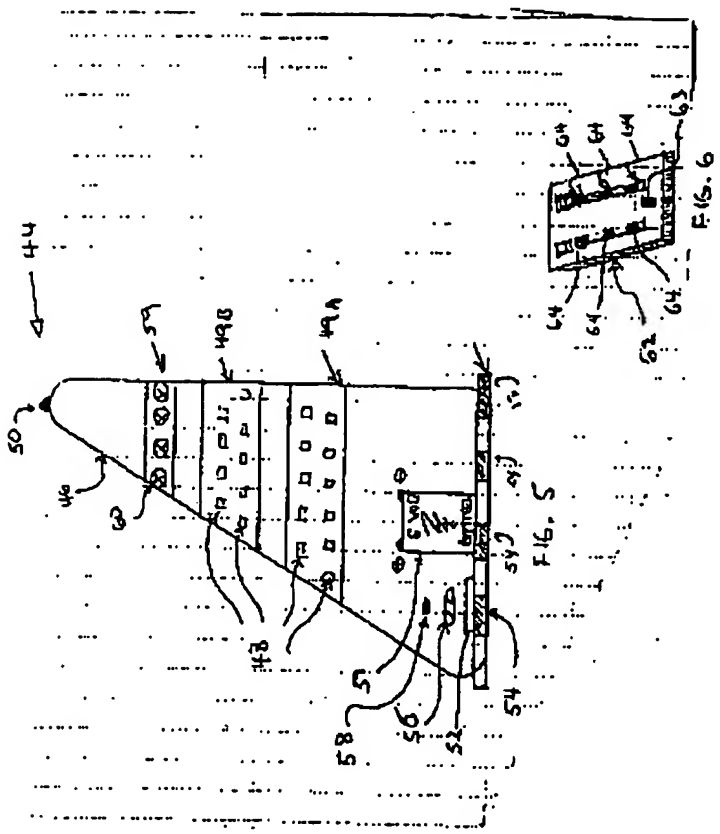

FIG. 5

FIG. 6

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